A REVIEW ON NEWBORN FACE RECOGNITION USING CONVOLUTIONAL NEURAL NETWORK

[1]SAYANA M S,[2]ANEESH G NATH
[1]Mtech Scholar,[2]Associate Professor
[1]Department of Computer Science and Engineering,
[1]TKM College of Engineering, Kollam,Kerala,India

Abstract:Face Recognition is a currently developing technology with multiple real life applications. In this paper, we concentrate on the newborn face recognition. Automatic face recognition of newborn avoids the swapping, abduction,erroneous drug delivery, kidnapping and provide accurate census. Newborn Face recognition is important other than technologies such as RFID bracelets foot prints and palm prints etc. The Numerous algorithms and techniques have been developed for improving the performance of face recognition. Recently Deep learning has been highly explored for computer vision applications. Convolutional Neural Networks can be used in order to extract relevant facial features from the images and provide higher accuracy for face recognition.This paper summarizes the challenges related to the newborn recognition jointly discuss methods related to newborn recognition.

IndexTerms **-Newborn face recognition, Deep Learning, Convolutional Neural Networks(CNNs).**

I. INTRODUCTION

Nowadays, increase the amount of crime against people.Because, people provide hints such as shape of face, eye, nose etc; for recognizing criminals. These problems allow us to know the need of strong technology. This technology is based on a technique called biometrics. Biometric is a form of bioinformatics that uses biological properties to identify people. Since biometric systems identify a person by biological characteristics, they are difficult to fake. Iris scanning, signature authentication, voice recognition and hand geometry are the example of biometrics. Here, face recognition has an important role for identifying the criminals. Face recognition is one example of biometric [15, 16] and it is use the character of the face to identify a person. Face recognition has drawn attention in computer vision at 1970 and the rest time the system of face recognition used was at 2001 for the purpose of reducing the crimes but this system fails to recognize the clear picture of any thiefbecause the thieves were wearing a mask.Think about another side of the crime, also increase kidnapping of newborn babies. Only the way of identifying their emotions from their face, for that face recognition is also important.Face recognition of newborn babies is an opportunity for the realization of several useful applications, such as improved security against swapping and abduction, accurate census, and effective drug delivery.

In the past few years, face recognition has received a significant attention and regarded as one of the most successful applications in the field of image analysis. Face detection can be regarded as fundamental part of face recognition systems according to its ability to focus computational resources on the part of an image containing a face. Face recognition is popular research area and also many works related to the face recognition. Among these works, only few works about newborn babies. So concentrate on the face recognition of newborn babies.In many under-developed and developing countries, most of the babies do not have appropriate official documents that can correctly identify them. Thus, there is a need for accurate biometric recognition of newborns and children.

Automated face recognition has received a lot of attention in the biometric literature [17], [18]. However, automated face recognition for newborns and toddlers still remains a challenging problem, which is yet to be properly explored. Increased cases of infant swapping, abduction from hospitals, erroneous transfers of newborns, and even incorrect drug deliveries in hospitals have been reported.There is a rising need for accurate face recognition of infants as well as in toddlers, primarily due to the lack of security measures in hospitals and intensive care centers.

II.CHALLENGES IN NEWBORN RECOGNITION

The difficulties in face detection mainly come from two aspects:

1)The large visual variations of human faces in the cluttered backgrounds;
2) The large search space of possible face positions and face sizes.

Face recognition is a long studied problem and several challenges have been identified by the researchers including pose, expression, illumination, aging, and disguise. With newborns, the challenges of aging and disguise are not manifested. However, pose and expression are two important covariates. Since it is difficult to make the newborns sit still and give good frontal images with neutral expression, they can be considered as uncooperative users of face recognition. They may also exhibit different posesand expressions, especially if they become uncomfortable while photographing. Another challenge is recognizing twins. Once twins grow up, they may develop differentiating looks but newly born twins are extremely similar.

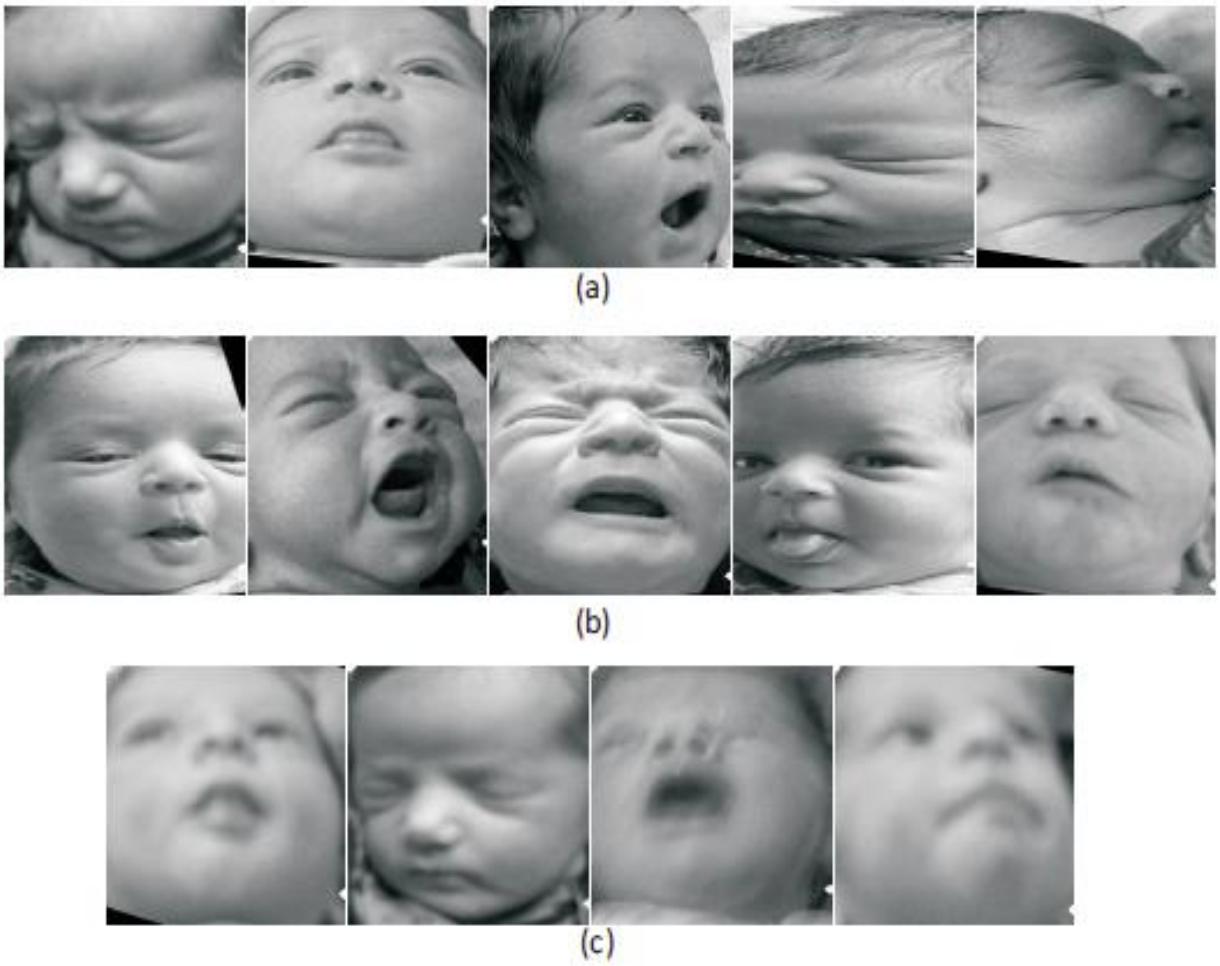

Figure 1. Some challenging images from database

Figure 2.Pair of twins present in the newborn face database.

II. METHODS USED FOR NEWBORN RECOGNITION

The ability to recognize and discriminate between faces is particularly important for social life in humans. Developmental studies of infants have provided evidence that this important ability exists at birth and that the face-processing biases found in adults are also evident early in infancy.

For face recognition there are two types of comparisons. The first is verification and the second is identification. Verification is compares the given individual with who that individual says they are and gives a yes or no decision. Identification is compares the given individual to all the other individual in the database and given a ranked list of matches.

Face recognition can be largely classified into two different classes of approaches, the local feature-based method and the global feature-based method. The Human faces can be characterized both on the basis of local as well as of global features. Global features are easier to capture they are generally less discriminative than localized features local features on the face can be highly discriminative, but may suffer for local changes in the facial appearance or partial face occlusion. Nowadays face recognition system is recognize the face using multiple-views of faces, for detecting each view of face such as left, right, front, top, and bottom *etc*.

Automatic recognition of newborns is a challenging problem with various applications. Current technologies that utilize RFID bracelets, color-coded tags, and foot printing to account for babies, these traditional approaches do not provide the required level of security.

Swapping of newborn babies is a very critical challenge that is faced by hospitals across the world. In United States, several studies have reported that every year around 1,00,000 - 5,00,000 newborn babies are swapped by mistake. Except for accidental swapping, there are kidnapping of babies and illegal adoption [1]. According to the National Center for Missing and Exploited Children, 270 cases reported the kidnapping of newborn or infant from year 1983-2010 [2].

Gray *et al.* finalize that, in the 34 newborns that are admitted to a neonatal intensive care unit at any given day, there is 50% chance of incorrect identification [3]. Hospital have plan several rules for correctly recognize the babies. One of the technique that are used by hospital is the ID bracelets, that are put on babies hands/legs right after birth, this is not a good method for prevent swapping of the babies. Because there are the number of cases that have been reported, among these cases there may be many of them undeclared or the parents and the children never come to know about it.

In medical science, different methods have been used to identify newborns. Deoxyribonucleic Acid (DNA) typing and Human Leukocyte Antigen (HLA) typing are very efficient and accurate methods for verifying the identity of babies. But these methods are rarely used for the verification of newborns because these methods are very time consuming and need high cost.

Foot and finger printing of child and mother is an another method for the identification of newborn. This method recommended by the Federal Bureau of Investigation [4]. Newborn identification formis used to store the foot print of the babies and finger print of the mother. Ink based methods are used for collecting the prints and then printed on the identification form. Shepard *et al.* presented the analysis of footprints on 51 newborns. The footprints were examined by fingerprint experts of the California State's Department of Justice [5]. Using the footprints, experts were able to identify only 10 babies. Based on these studies, the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists stated that *individual hospitals may want to continue the practice of foot printing or fingerprinting, but universal use of this practice is no longer recommended*.

Weingaertner*et al.* [6] and Lemes*et al.* [7] carefully captured footprints and palmprints of 106 newborns at high resolution using specialized sensors to improve useful biometric information content.

Fields *et al.* [8] and Tiwari *et al.* [9] studied the feasibility of ear recognition for newborns and indicated that ears might provide distinguishable features for newborn recognition.

Recently, Jain *et al.* [10] showed the effectiveness of fingerprints for a larger age group encompassing both newborns and toddlers.

To overcome the difficulties convolution neural network is the best solution. A convolutional neural network is a feed-forward network with the ability of extracting topological properties from the input image. It extracts features from the raw image and then a classifier classifies extracted features.

Many works related to the face recognition using convolution neural network. So detailed study of this area identified that few works related to newborn baby face recognition. Determination of newborn baby face recognition using convolution neural network is still an open area in the face recognition. CNNs can learn rich feature representations for a wide range of images.

IV.CONVOLUTIONAL NEURAL NETWORK

Convolutional neural networks(CNN) is one type of deep neural network and it has wide applications in image and video. In deep learning, CNN is important factor for recognizing object in image or video.

Many recent works use CNNs to achieve state-of-the-art performance, including image classification, object tracking, pose estimation, text detection, visual saliency detection, action recognition, scene labeling, speech and natural language processing. There are several architectures in the field of Convolutional Networks they are, LeNet, AlexNet, ZF Net, GoogLeNet, VGGNet, ResNet, main difference between these architectures is that the number of layers used. Similar to the artificial neural network CNNs also have three layers namely, convolution layer, pooling layer and fully-connected layer.

The convolutional layer aims to learn feature representations of the inputs. convolution layer is composed of several convolution kernels, neurons or filter which are used to compute different feature maps. Specifically, each neuron of a feature map is connected to a region of neighbouring neurons in the previous layer. Such a neighbourhood is referred to as the neuron's receptive field in the previous layer. The new feature map can be obtained by first convolving the input with a learned kernel and then applying an element-wise nonlinear activation function on the filtered results. To generate each feature map, the kernel is shared by all spatial locations of the input. The complete feature maps are obtained by using several different kernels. The activation function introduces nonlinearities to CNN, which are desirable for multi-layer networks to detect nonlinear features. The pooling layer aims to achieve shift-invariance by reducing the resolution of the feature maps. It is usually placed between two

convolutional layers. Each feature map of a pooling layer is connected to its corresponding feature map of the preceding convolutional layer. The kernels in the 1st convolutional layer are designed to detect low-level features such as edges and curves, while the kernels in higher layers are learned to encode more abstract features. By using several convolutional and pooling layers, gradually extract higher-level feature representations.

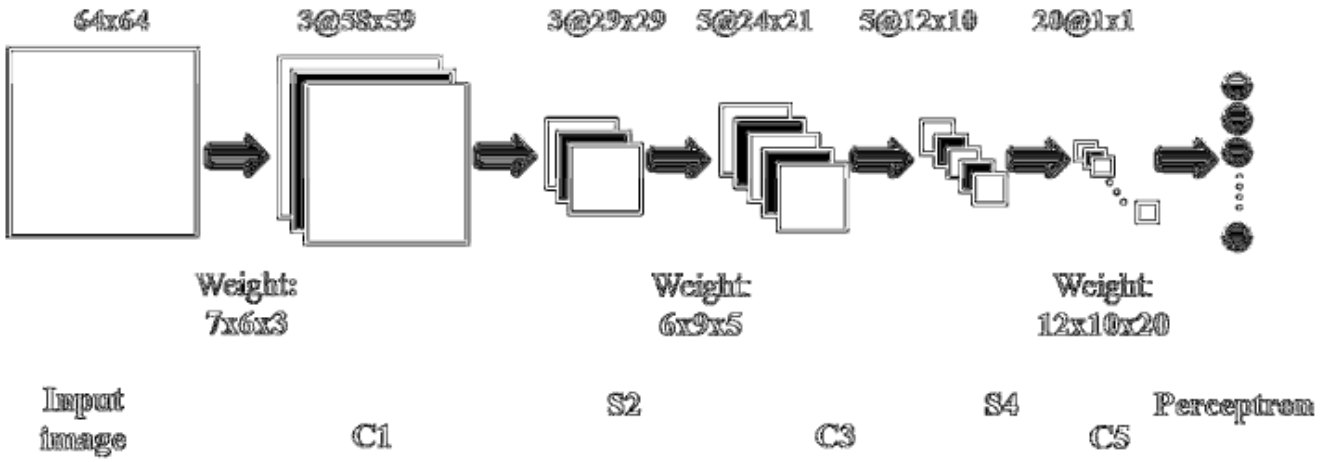

Figure 3. Architecture of CNN

V.CONCLUSION

In this paper, we briefly discuss the application and challenges of newborn recognition. In addition, we also discuss the general methods used for newborn recognition. The newborn recognition can be performed using different methods such as RFID bracelets, foot prints and palm prints etc. Different challenges occurred during these methods and also take more time for recognition. Automatic face recognition of newborn using convolutional neural network outperformed previous classification methods and provide better recognition accuracy. The convolutional neural network also provide high accuracy than other feature extraction method.

VI.ACKNOWLEDGMENT

We would like to express our thanks to Dr.S.Ayoob, Principal of T.K.M College of Engineering andDr.Ansamma John, Associate Professor and Head of the Department, CSE, T.K.M College of Engineering, for constant support and encouragement throughout the successful completion of this paper. I also express my thanks to my all friends who helped me in my work.

REFERENCES

[1]"*http* : *//www.amf or.net/stolenbabies.html*", Last accessed on June 4, 2010.
[2] "*http ://www.missingkids.com/enus/documents/in f antabductionstats.pdf* "Last accessed on June 4, 2010.
[3]J.E. Gray, G. Suresh, R. Ursprung, W.H. Edwards, J. Nickerson, and P.H. Shinno, "Patient misidentification in the neonatal intensive care unit: Quantification of risk", *Pediatrics*, vol. 117, pp. e46–e47, 2006.
[4]M.E. Stapleton, "Best foot forward: Infant footprints for personal identification", Law Enforcement Bulletin 63, FBI, 1999.
[5]K.S. Shepard, T. Erickson, and H. Fromm, "Limitations of footprinting as a means of infant identification", *Pediatrics*, vol.37, no. 1, 1966.
[6]D. Weingaertner, O.R.P. Bellon, M.N.L. Cat, and L. Silva, "Newborn's biometric identification: Can it be done?",in*International Joint on Computer Vision, Imaging and Computer GraphicsTheory and Applications*, 2008.
[7]C. Fields, C.F. Hugh, C.P. Warren, and M. Zimberoff, "The ear ofthe newborn as an identification constant", *Journal of Obstetrics and*, vol. 16, pp. 98–101, 1960.
[8]S.Z. Li and A.K. Jain, *Handbook of Face Recognition*, Springer, NewYork, 2004.
[9]J. Daugman, "New methods in iris recognition", *IEEE Transactionson Systems, Man and Cybernetics B*, vol. 37, no. 5, pp. 1167–1175,2007.
[10]D. Kuefner, V.M. Cassia, M. Picozzi, and E. Bricolo, "Do all kidslook alike? evidence for an other-age effect in adults", *Journal ofExperimental Psychology: Human Perception and Performance*, vol.
[11] Y. LeCun, Y. Bengio, and G. Hinton, "Deep learning," Nature, vol. 521, no. 7553, pp. 436–444, May 2015.
[12] L. Deng, et al., "Recent advances in deep learning for speech research at Microsoft," in Proc. ICASSP, 2013, pp. 8604–8608.
[13]A. Krizhevsky, I. Sutskever, and G. E. Hinton, "ImageNet classification with deep convolutional neural networks," in Proc. NIPS, 2012, pp. 1097–1105.
[14]O. Russakovsky, et al., "ImageNet large scale visual recognition challenge," Int. J. Comput. Vis., vol. 115, no. 3, pp. 211–252, Dec. 2015.

[15]H. Veronica.(2001) \Biometrics: Face Recognition Technology".GIAC, SANS Institute. pp.2-3 Accessed at March 7th,2011: http://www.giac.org/download.php?p=gsec 627&c=6203efa1e18401f74c8870e2f54fbb3b

[16]A. Ajit.(2008). \face recognition technology".cochin univer- sity of science & technology,kochi - 682022. Accessed at March 10th, 2011:

[17] M. Du, A. C. Sankaranarayanan, and R. Chellappa, Robust face recognition from multi-view videos, IEEE Trans. Image Process., vol. 23, no. 3,pp. 1105–1117, Mar. 2014.

[18]H. S. Bhatt, R. Singh, M. Vatsa, and N. K. Ratha, Improving crossresolution face matching using ensemble-based co-transfer learning, IEEE Trans. Image Process., vol. 23, no. 12, pp. 5654–5669, Dec. 2014.